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PREPRODUCTION ENVIRONMENTAL TESTING OF AN/ASQ-10 AND RO-32 RECO--ETC(U)

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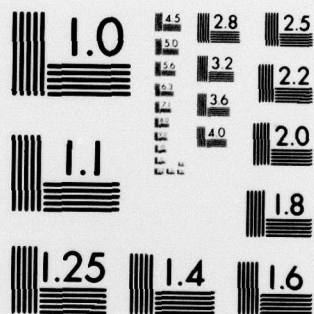
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## S U M M A R Y

## SUMMARY OF RESULTS

Preproduction testing of the AN/ASQ-10 MAD built by the Dubrow Electronic Industries, Inc. (DEI), Contract N0w-61-0183 revealed discrepancies and/or problems in the following areas:

- |                      |                                   |
|----------------------|-----------------------------------|
| 1. Servo error       | 5. Humidity tests                 |
| 2. Wobble oscillator | 6. Temperature and altitude tests |
| 3. Vibration tests   | 7. Interference tests             |
| 4. Noise tests       | 8. Shock tests                    |

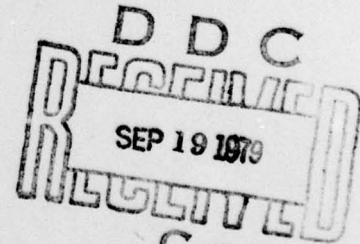
## CONCLUSIONS

The preproduction evaluation model AN/ASQ-10 built by Dubrow Electronic Industries, Inc. is not acceptable in its present form because it will not meet the requirements of Specification No. MIL-D-19142A, reference (a).

## RECOMMENDATIONS

It is recommended that:

1. The discrepancies in the equipments and their performances be corrected by the contractor.
2. Vibration tests of the RO-32 recorder be repeated after improvements are made so as to ensure that this equipment passes the 10 g vibration test of Specification No. MIL-T-5422E(ASG), reference (b).
3. Servo error (follow-up-lag) be held within the 3 minutes of arc for angular motion of 1 radian/sec velocity and 3 radians/sec/sec acceleration.
4. Quality of workmanship be improved on the AN/ASQ-10 and RO-32 recorder.
5. The contractor incorporate means to decrease the susceptibility of the AN/ASQ-10 to audio frequencies.



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FINAL REPORT  
PREPRODUCTION ENVIRONMENTAL TESTING OF  
AN/ASQ-10 AND RQ-32 RECORDER, MANUFACTURED BY  
DUBROW ELECTRONIC INDUSTRIES, INC.  
BURLINGTON, NEW JERSEY

WEPTASK NO. RUDC4B000/2021/FO01-06-001  
Task No. 310

- 
- Ref: (a) Spec No. MIL-D-19142A, "Detecting Set, Magnetic; AN/ASQ-10"  
(b) Spec No. MIL-T-5422E(ASG), "Testing, Environmental, Aircraft Electronic Equipment"  
(c) Spec No. MIL-I-6181D, "Interference, Controlled Requirements, Aircraft Equipment"

DESCRIPTION OF EQUIPMENT

The AN/ASQ-10 magnetic detecting set is an airborne magnetometer designed to detect the presence of a submarine by measuring the magnetic anomaly produced on the earth's magnetic field by the submarine. The AN/ASQ-10 and the AN/ASQ-8 are similar in principles of operation. Both equipments contain virtually the same detecting head and can be used with the same recorder. The AN/ASQ-10 is smaller in size and the circuitry is not as complex as the AN/ASQ-8.

TESTS AND RESULTS

Bench and environmental tests were conducted on the AN/ASQ-10 equipment, manufactured by DEI, and the discrepancies resulting from these tests are described in the following:

Servo Error - The servo error (follow-up-lag) was excessively high for the outer axis, approximately 5.5 min of arc, and marginal for the inner axis, approximately 3.0 min of arc. The servo error should not exceed 3.0 min of arc for angular motion of 1 radian/sec velocity and 3 radians/sec/sec acceleration.

Wobble Oscillator - The internal test method for servo error utilizes a wobble oscillator in the magnetometer amplifier chassis. The test is performed with the detecting head placed in a magnetic field between 24,000 and 70,000 gammas with the ambient noise less than 1 gamma. The function switch is turned to either inner or outer servo and the servo error is observed on the recorder. Each axis is measured. The indication must be less than two major divisions peak-to-peak, the deflection supposedly equal to 3 min of arc, servo error peak-to-peak. This was not the case with the DEI AN/ASQ-10 equipment because the wobble oscillator output was low and made the servo error appear unrealistically low (1 min for each axis). The internal test was checked against the rocking cradle method and it was found that the servo error was excessively high.

Noise Tests - The investigation of the noise of the DEI AN/ASQ-10 was accomplished under laboratory conditions. The detecting head was placed in an AN/ASM-3 shield-can to reduce external noise. The noise level on the DEI AN/ASQ-10 equipment was 0.2 gamma peak-to-peak and higher; this noise level exceeds the 0.1 gamma peak-to-peak requirement for maximum allowable noise. The high noise level problem was traced to a defective input filter in the magnetometer amplifier. This filter was replaced and the noise level dropped to within the required level of 0.1 gamma peak-to-peak.

Vibration Tests - The AM-1967/ASQ-10 amplifier and the C-2548/ASQ-10 control console were placed on the vibration table, and the DT-239/ASQ-10 detecting head was placed in a remote area away from the vibration machine; the detecting head was placed inside shield cans. The amplifier and the control console were vibrated with and without vibration isolators. Then the detecting head was placed on the vibration machine and was tested only for that portion of the test applicable to equipment with vibration isolators. No operational tests were performed with the detecting head on the vibration table. The frequency range for the vibration was from 5 to 55 cps, with an amplitude of 0.06 inch peak-to-peak. The amplifier and control console passed all the vibration tests.

The detecting head passed all vibration tests except one. When the head was vibrated in the lateral direction (transverse) the front vibration isolators became twisted because the mounting studs were not sufficiently tight. The mounting studs were properly adjusted and tightened and the vibration test was satisfactorily completed on the detecting head.

The RO-32 recorder had many discrepancies. They are listed in their order of occurrence:

1. The S-101 function switch failed during temperature/altitude tests at -32° C and at 10,000 feet. A new switch was installed and the tests were resumed.
2. The ball pen inking system was erratic and inking was very light through most of the tests.
3. With the vibration driving force in the horizontal plane and the vibration frequency varied from 70 to 90 cps; the recording pens tore the paper tape chart.
4. Case of the recorder cracked open when the driving force was in the horizontal plane and the frequency of vibration was varied from 70 to 90 cps.
5. Vibration loosened the mountings on Capacitors C-110 and C-107 and caused the leads to break on both capacitors.



6. Leads on Capacitor C-112 were also broken because of vibration. The small teflon coated wires (leads to Capacitor C-112) were replaced with more flexible wires. This corrected the trouble.
7. The recorder feedback potentiometer (or follow-up potentiometer for pen drive assembly, R-123) became "open" as a result of vibration.
8. Vibration also caused breakage of wires connected between function switch S-101 and a terminal board. During the same test run, a wire broke away from a pen drive motor.
9. Broken leads on Capacitors C-106, C-107 and C-111 were found after another vibration test.
10. The recorder chart transport mechanism vibrated out of the case with vibration in the horizontal plane. This happened several times. This condition has not been remedied.
11. The latch on the plexiglass door did not hold during vibration in the horizontal plane; consequently, the door was removed to complete the vibration run. Also it was apparent during this run that the upper paper roll holder did not have enough tension to hold the paper reasonably tight. As the cycling passed through the resonant frequency, the paper would feed out faster than the chart drive/take-up mechanism would roll it up. This condition has not been remedied.

Humidity - The complete AN/ASQ-10 equipment was installed in the humidity chamber and was subjected to the entire humidity test of Specification No. MIL-T-5422E(ASG). The equipment was then removed for inspection and given a complete performance test. Inspection revealed that the inner axis on the DT-239/ASQ-10 detecting head was not operating properly. The trouble was located in the inner axis amplifier and replacement of a Capacitor (C-1718) restored normal operation. The recorder was found to be defective after it was taken out of the humidity chamber. The black pen amplifier was not operating properly. A broken wire was found on Capacitor C-111 and was repaired; this failure was probably a result of vibration.

Temperature and Altitude Tests - During the high temperature test, the RO-32 recorder chart drive motor failed. The trouble was caused by a bearing failure. A new motor was installed and tests were continued.

Interference and Susceptibility Tests - The AN/ASQ-10 detecting set did not meet Specification No. MIL-I-6181D, reference (c), standards for radio interference and audio frequency susceptibility.

Conducted Interference - The interference emanating from the equipment was a 400-cycle broadband tone. Tests were conducted to determine the source of trouble and revealed that the black pen servo amplifier of the recorder was causing most of the interference. Replacement of this unit



and insertion of a 0.1 uf capacitor across the primary of the 400-cycle transformer reduced the interference to within the limits of specifications.

Audio Frequency Susceptibility - The AN/ASQ-10 equipment was susceptible to a sinusoidal signal of 3 v amplitude (rms) introduced into the 28 vdc power lines. Excessive chatter of the recorder pens was observed as the frequency of the interfering signal was varied between 385 and 425 cycles. Although the noise, due to susceptibility, barely increased the normal noise level by 0.05 gamma and was well under 0.2 gamma peak-to-peak, the reaction of the pens was considered abnormal and could cause trouble or excessive wear under operational conditions. The test results of audio frequency interference on the 400-cycle power line showed that the AN/ASQ-10 equipment was susceptible to voltages much less than the limit specified. The frequency of maximum susceptibility occurred at 200 cycles, and the threshold voltage was approximately 24 db out of specification. The frequencies of susceptibility were found to have a definite harmonic relationship with the generator used in the test setup, the 400-cycle power line, and the AN/ASQ-10 500-cycle oscillator. Audio frequency susceptibility was reduced by inserting a 0.1 uf capacitor across the primary of the 400-cycle power transformer. The Rectifiers CR-1601, CR-1602, CR-1603, and CR-1604 were relocated closer to the power transformer. The earth's field bias circuitry was completely shielded. With these changes, the equipment meets the audio susceptibility requirements of Specification No. MIL-I-6181D.

Shock Tests - The AM-1967/ASQ-10 amplifier-power supply was mounted on a shock test fixture including the vibration isolators in order to simulate an actual service installation. The equipment was shocked in six directions in accordance with Specification No. MIL-T-5422E(ASG) and then it was inspected. The mounting base assembly was not considered acceptable because the shock mounts did not have sufficient stiffness to prevent "bottoming out" of the amplifier-power supply unit when the shock was applied in the vertical direction. This condition was cleared up by the contractor in the production models by using more suitable shock mounts. The control console and the recorder were tested next and passed all shock tests, except when the shock was applied in the longitudinal direction the plastic door on the recorder dropped out. The detecting head was shock tested and failed to meet the shock test standards of Specification No. MIL-T-5422E(ASG). Shock and vibration isolators A-404 and A-405 of the detecting head bottomed and made metal-to-metal contact with the O-416 shock-mount plate-assembly when the detecting head was subjected to 15 g tests along its longitudinal axis. The above-mentioned discrepancy can be corrected by using neoprene mounts with a durometer rating of 76 as called out in BUAER drawing No. 42947 for AN/ASQ-10 shock and vibration isolators.

Salt Spray - The AN/ASQ-10 and RO-32 recorder were placed in a salt spray chamber in such a manner as to simulate actual service installation. The

equipment was subjected to 48 hours of salt spray test according to Specification No. MIL-T-5422E(ASG). The equipment was then removed for inspection and performance tested.

### Results

1. There was no inner and outer drive signals to the inner and outer gimbals.
2. The wobble oscillator did not function.
3. The outer spike control potentiometer R-1620 failed.

### Corrections

1. Tube pins of V-1201 were cleaned and the tube was replaced. The capacitor network pins (Z-1202) were also cleaned.
2. The wobble oscillator performed properly after making the above corrections.
3. The outer spike control potentiometer was replaced.

Summary - All of the electrical tests were made and the equipment performed normally.

The tests remaining to be conducted under Specification No. MIL-T-5422E(ASG) are the explosion and final electrical tests which will be sent out as an addendum to this report.

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